IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application
Inventors: DeOrnellas, et al.
Application No.: 09/888,365
Confirm. No.: 8894
Filed: June 22, 2001
Title: IMPROVED REACTOR WITH HEATED AND TEXTURED ELECTRODES AND SURFACES

PATENT APPLICATION

Art Unit: 1763
Examiner: Alejandro Mulero, Luz L.

Customer No. 23910

DECLARATION

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 223 13-1450

Sir:

I, Stephen P. DeOrnellas, declare as follows:

1. That I am a named inventor in the above-referenced U.S. Patent Application No. 09/888,365, hereinafter cited as the '365 application.

2. That I have reviewed the latest claims describing the invention in the '365 application that were filed with an Office Action Response on September 16, 2004.

3. That the attached lab notebook entries include pages 3, 4, 57, 87, and 92-93 from the lab notebook of Kurt Olson, a co-inventor of the '365 application and an employee of Tegal, the assignee of the '365 application (hereinafter the Olson notebook). Note that some information has been redacted from the Olson notebook entries.

4. That the Olson lab notebook entries were signed Kurt Olson, witnessed by Scott

Hendrickson (an employee of Tegal) and verified by Paritosh Rajora (an employee of Tegal), and were made at my direction and with my knowledge at the time the entries were made.

5. That I believe the lab notebook entries show discovery and conception of the claimed invention in the '365 application. Page 3 shows the work of Pt etch using Cl_2/O_2. Page 4 shows the continued development of Pt etch, employing Ar/Cl_2 at a wafer temperature of 300°C to minimizing critical dimension gain. I believe that conception of heating the chamber wall surface to a high temperature is shown in page 57, in response to the observation that Pt starts flaking from the chamber wall surface onto the wafer. Pt is believed to come from the wafer during the etch process step, and deposits on the chamber wall surface. The Pt film deposited on the chamber wall surface is observed to have poor adhesion, and therefore easily flakable upon reaching a certain thickness. I believe that conception of heating the chamber wall surfaces to improve the adhesion of Pt to prevent flaking is also shown in page 87.

6. That I believe the lab notebook entries on pages 92-93 show the summary of the discovery and conception of the invention. Page 92 shows the statement of the problem, the delamination of deposited material from the interior chamber wall surfaces due to poor adhesion. Page 92 further shows the discovery of heating the chamber wall surfaces to elevated temperatures (>300°C) to significantly increase the adhesion strength of the deposited layers. Figures 1 and 2 of the discovery data are shown in page 93. Fig. 1 shows, as a function of etch time, the poor adhesion strength of the deposited film (signified by failing the tape test) at low wall temperature of 80°C, and the improved adhesion strength of the deposited film (signified by passing the tape test) at high wall temperature of 300°C. Fig. 2 shows the adhesion strength as a function of wall temperature. Poor adhesion and good adhesion are observed at 80°C and 300°C respectively, with an intermediate adhesion strength at an intermediate wall temperature.

7. That I believe the lab notebook entries show the novelty and non-obviousness of the present invention, and not a routine experimentation for optimization or workable ranges.

Not only is the link between the chamber wall temperature and the adhesion strength of the deposited layers not obvious, but the discovery of the temperature range of 300 to 500°C is further proof of the present inventiveness.

8. That the above statements were made with the knowledge that willful false statements and the like are punishable by fine and/or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that any such willful false statement may jeopardize the validity of this application or any patent resulting therefrom.

3-9-05
Date

Stephen P. DeOrnellas

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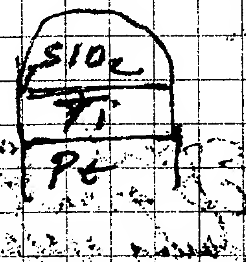
Patent Idea

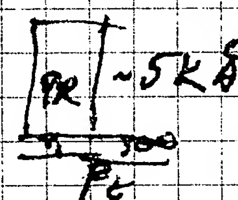
Ti Cap on Pt: use Ti Cap as mask for Pt Etch

Samsung Did w/ SiO_2 Mask



We can do it with

Photo Resist and Ti



Open Ti

Then etch Pt with Cl_2/O_2

to get selectivity to Ti "mask"

Remaining Photo Resist gets Removed during Cl_2/O_2 step

No strip Required.

Kurt Olson
Paritosh Rajora
Lou Jerde
Al Cober

Continued on Page

[signature] Signed 3/15/97 Date Read and Understood By Signed Date

PROJECT

Notebook No.

Continued From Page

Patent Idea

Run Ar etch w. Ar/Cl_2 @ 300°C to measure CD gain

Patent Idea Start etch with HBr to measure CD growth from Cobalt Etch deposition during wafer heat up.

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3/17/97

Date

Signed

Date

Hold chamber surfaces @ ____°C to minimize
expos and maximize duration before flaking.

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CT

Patent Ideas — Heated surfaces for Adhesion Improvement for Pt/SiO2 Ir... Systems

Staff Meeting 6/30

- Opening Freq.
  - 300° Working well enough for Tests
  - DRAM Photoresist Process OK with 300°C
  - Oxide vs Temp ~~...~~ No knee in curve — Needs 300°C
  - OK Adhesion on electrode
  - Unzips on piece — harder Test
  -
- Particles @ Sputtering — Les trying to arrange for service person to come here train techniques for Particle source identification and Data Collection

  Should be Process Application

- Lance ~~...~~ Involved — overetches. Identify potentially beneficial overetch regions. Characterize Deposition and implications for Delamination. Follow up on No Strike @ Nickel Industry
- Project ~~...~~ Sheet Review — Summary complete. Type it up Today. 2 pages. ASAP. George, Steve, Les

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Signed | Date | Signed | Date

Patent Idea: Adhesion promotion for the Pt/SiO_2 etch system
Inventors: Kurt Olson, Scot Hendrickson
Problem: Delamination of Deposited Material from the interior chamber surfaces of a Pt/SiO_2 etch Plasma system.

Forming a device by etching Pt and subsequently an SiO_2 underlayer results in the deposition of materials containing Pt and containing Si and O. When Pt and SiO_2 are etched sequentially in the same chamber, Layered deposits are formed with the layers alternating between Pt and SiO_2 like materials.

Adhesion is poor because of inherently poor adhesion between Pt and SiO_2. Consequently the layers delaminate when exposed to small stresses resulting from deposition of subsequent layers.

Invention: (We have discovered)

By heating the chamber surfaces to elevated Temperatures (>250? >300K) for the System(s) using a Sputtering Gas (Argon, Xe, ...) and and/Cl_2 (HCl? HBr, F_2? (CF_4?) that the adhesion strength of the deposited layers can be significantly increased.

The effect which is important is the ability to prevent the formation of a continuous SiO_x deposit. We have observed improved adhesion (Ability to survive "tape test") for SiO_2 etches up to 5 minutes which corresponds to ~3000 - 5000 Å of removal of SiO_2.

Continued on Page 9

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Kurt Olson 7/24/97 Signed Date
Scot Hendrickson 7/24/97 Signed Date
Verified by: Carolyn Rogers 7/24/97

Patent Idea (Cont'd from P 92

Invention: Cont'd

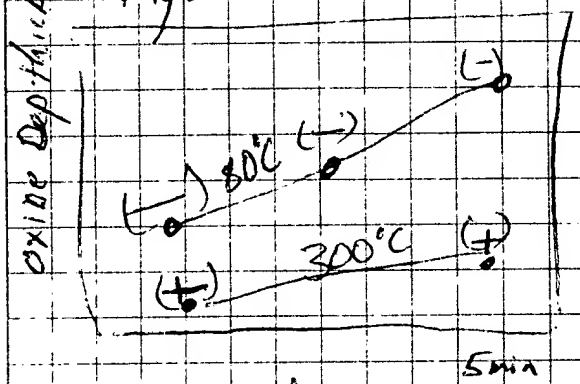
We have also shown that for a given etch time (5 min.) The adhesion improves with temperature. (Fails Tape test @ 80°C Passes with 300Å surfaces)

System: Pt / SiO_2

Plasma Etch with Ar/Cl_2

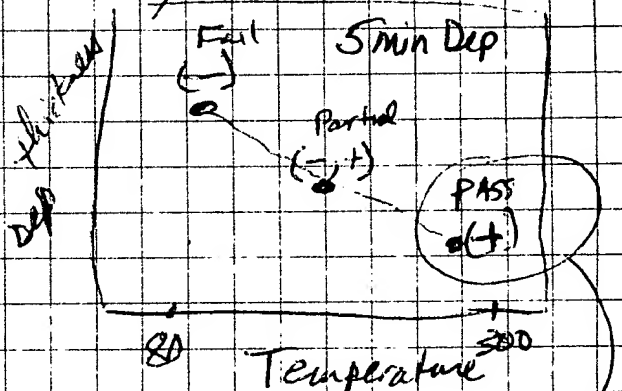
Surface Temperature > 250?, 300?

Figure 1

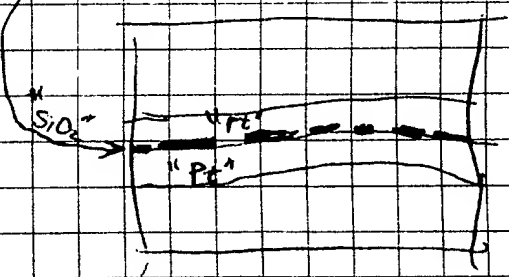


(+) = Passed Tape Test

Figure 2



SEM shows Discontinuous Deposit SiO_2 Pt Layers contact each other



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Witnessed by: Darren Page 7/24/97